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ABSTRACT

The first of two papers presented in this section, "Price-Caps: Theory and Implementation" (Peter B. Linhart and Roy Radner) describes a proposed method of regulation involving price caps on core services and no price regulation of other services. This method is designed to replace rate-of-return regulation during a transition period to a deregulated long-distance telecommunications industry. In particular, the following implementation issues are addressed: (1) which services should be capped; (2) the starting point for the cap; and (3) changes in the economic environment that should be reflected in the cap, and how they should be reflected. The paper is supplemented by a table, and contains 12 footnote citations. The second paper, "Alternatives to Rate of Return Regulation" (Ingo Vogelsang) (abstract only) introduces a regulatory two-part monopoly pricing mechanism which permits a firm to freely choose the variable price of the two-part tariff as long as the fixed part obeys a constraint. It is noted that the firm using this mechanism will in every period receive an approximation to the welfare change caused by its price changes over the last period, and, contrary to most other suggestions for incentive pricing, this approach requires no government subsidies. (Author/EW)

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## Alternatives to Rate of Return Regulation Section

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# Price-Caps: Theory and Implementation

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*ABSTRACT*

In several previous papers, we have proposed a method of regulation designed to replace rate-of-return regulation during a transition to a deregulated long-distance telecommunications industry. The proposed method involves price caps on core services, and no price regulation of other services. Regulatory methods of this type are now being discussed as practical possibilities for both state and federal regulation, and such a method is actually in operation in Great Britain. In the present paper, after reviewing the motivation for price-cap regulation — in particular its desirable incentive properties — we attempt to answer some essential questions that arise in connection with actual implementation, such as: What services should be capped? What should be the starting point for the cap? What changes in the economic environment should be reflected in the cap, and in what way?

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# Price-Caps: Theory and Implementation

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## 1. Introduction[1]

We have been speaking and writing for some years[2] about the desirability of replacing rate-base rate-of-return regulation (from now on denoted R/R) by a cap on the price of core service (where "core service" is to be defined below), with no price regulation of other services. We shall not repeat those arguments here, although we do have some new points to make about the purposes of regulation and how price caps would accomplish those purposes.

Price-cap regulation is now being discussed in this country as a real possibility for telecommunications,[3] and a system of this sort already exists in Great Britain.[4] Therefore, we want to say something about how price-caps might actually be implemented for telecommunications in the U.S., and about some of the decisions that would have to be made in the course of specifying such implementation. (The word "actually" in the preceding sentence should be taken with a grain of salt; this paper still represents a theoretician's view of "reality," and does not attempt to treat the working out of many indispensable details.) The discussion will be carried out mostly in terms of AT&T, but it should be applicable, in large part, *mutatis mutandis*, elsewhere.

The remainder of this paper is laid out as follows: In Section 2 we discuss the purposes of regulation. In Section 3 we explain how price caps would achieve those purposes. In Section 4 we discuss implementation, i.e., what services would be capped, how the caps would be initialized, and how they would be adjusted. Finally, in Section 5, we summarize the arguments, and compare and contrast price-cap regulation with R/R.

## 2. Purposes of Regulation

The purposes of price regulation are two. The first is to prevent a firm from pricing too high, i.e., to act like competition in preventing the firm from extracting monopoly profits ("monopoly rents") from its customers, in cases in which competition itself does not do so, i.e., when the firm has significant market power.

R/R attempts to achieve this end by setting prices so that total revenue equals total cost, i.e., by setting the firm's rate of return equal to the cost of capital. This equality can be required either for the firm's costs and revenues in the aggregate, or separately by service categories, variously defined. The latter method of course involves allocation of joint and common costs among service categories; such allocations are by their nature arbitrary; they are also expensive, since they have redistributive effects and hence become the focus of political struggles, as we have discussed elsewhere. If the firm's business is partly regulated and partly unregulated, as is the case with AT&T, these cost-allocation problems become exacerbated.

We note that, since the firm know its own costs better than the regulators do, the problem of setting prices under R/R has the form of a principal-agent problem.[5] The difficulty with R/R goes deeper than this, however: even if the firm's costs were perfectly known to the regulators, and if the latter could set prices so that total revenues equaled total costs at every instant, R/R would provide no incentive for reducing costs, and no incentive for innovation. R/R treats costs as if they were exogenously given.

This brings us to the second purpose of regulation, which starts from the observation that costs and technology are to a significant degree endogenously determined. This purpose is (or should be) to provide, or at least not prevent, incentives for cost-reduction, provision of new products, and development of new technology — at least where such

changes are economically desirable.

This second purpose is dynamic, where the first is static. It seeks to mimic, not just static competition, but Schumpeterian competition.[6] We might call such a system "Schumpeterian regulation." In "the old days," when the Bell System had a monopoly on the provision of many telephone services, inflation was low, rate reviews were infrequent, and the expansion of the technological frontier was less rapid than at present, Schumpeterian regulation was probably achieved by regulatory lag, as Baumol has suggested;[7] the Bell System may also have found reasons to contain and reduce its costs, and to maintain and improve its services, in the desire to avoid rate reviews and to maintain its monopoly.

Price caps are intended to provide such dynamic incentives under present circumstances. Price-cap regulation should also fulfill the first purpose of regulation, by keeping revenues in the neighborhood of costs, but costs that are decreasing more rapidly than they would under R/R.

### 3. Price-Caps: Their Nature and Function

A *price cap* is an upper bound, set by the regulatory commission, on the price of core services. A *core service* is a service for which the firm is thought to have significant market power. A service might be labelled "core" in order to reassure consumers, whether or not the firm actually had significant market power in that service. Inter-LATA telephone service in the U.S. may well be competitive now (we think it is). If so, a properly constructed price cap would not be constraining; it would just be a "safety net."

Price caps may be temporary or permanent. In the case of AT&T, we think that the price-cap regime should be a transition, lasting perhaps five years, to genuine deregulation (more precisely, probably to some form of regulatory forbearance). In the case of British

water authorities,[8] because they hold regional monopolies, the price cap regime will probably be permanent.[9]

Questions about the implementation of price-cap regulation fall under three headings:

a) What services should be capped?

b) What should be the starting point for the cap?

c) What changes in the economic environment should be reflected in the cap, and in what way?

In the next section, we take up these three questions in turn. First, however, we give an explicit statement of the desirable incentive properties of price-cap regulation, as follows:

If the cap is fixed as a function (i.e., as an algorithm) in a way that does not depend on the actions of the firm, then the firm can keep every dollar of cost-reduction that it can achieve. Thus it has the incentive to expend the socially optimal amount of cost-reducing effort (socially optimal in the narrow sense of maximizing consumer plus producer surplus). This would be the case exactly, were it not for two considerations:

a) New technology may be imitated and may diffuse to competitors, or it may become obsolete. To this extent, the firm does not capture all the returns from its own investment in cost-reduction. But this is also a feature of Schumpeterian competition.

b) If the price-cap formula turns out to be incorrect, it may have to be revised. That is, if the firm's profits are conspicuously high, the regulators will want to revise the cap formula downward; if the cap forces the firm to operate in the red, the firm will appeal to have the cap formula revised upward. This possibility of future revision spoils the "purity" of the incentives to some extent. But, in a world with uncertainty and incomplete information, no regulatory mechanism can provide perfect incentives (this can

be shown theoretically).[10] Our point is thus that a properly constructed price-cap mechanism would provide incentives that are better than those provided by R/R.

The regulators should, of course, not lower the cap just because the actual price path stays below the cap for some length of time. The perverse incentive effects of such behavior are obvious.

## 4. Implementation of Price Caps

### a. What should be capped?

As stated above, the price of core service, where market power resides or is thought to reside, should be capped. For AT&T, this might mean Message Toll Service (MTS), or some parts of MTS.

But there are many MTS prices, generally expressed in dollars per minute, say; these prices are distinguished by time of day, length of haul, operator-assisted or not, and so on. Thus what must be capped is an aggregate price index of MTS services. We suggest that this index be formed by weighting prices according to usage in some base period.[11] It may be helpful to write out the above statements in algebra:

Let $p_i^t$ = price of a minute of type $i$ in period $t$.

Let $v_i$ = relative number of minutes of type $i$ used by all callers in the base period, so that $\sum v_i = 1$.

The price index in period $t$ is then

$$\bar{p}_t = \sum v_i p_i^t.$$

Denote by $P^t$ the cap in period $t$. Then price-cap regulation simply requires that

$$\bar{p}^t \leq P^t. \qquad (*)$$

A single aggregate cap would give the regulated firm maximum pricing flexibility, enabling it in this respect to act as much as possible like an efficient competitive firm. However, distributive considerations, either of equity or of politics, may require in addition the imposition of looser caps on sub-aggregate price indices, for example for evening rates.

We emphasize, however, that prices of services that are not "core," in the sense defined in this paper, need not and should not be capped.

**b. Starting point for the cap**

We suggest that the starting point for the cap should be the price index at the time price-cap regulation is instituted.

There might be two kinds of exception to this rule. First, the cap might be adjusted in such a way as to bring rate of return up to, or down to, the allowed level as of the time R/R is abandoned. Second, the initial cap might be adjusted to correct egregious anomalies or inequities in prices as of that time. (Note that such an adjustment in the initial cap would not mean that *prices* themselves would be so adjusted. Once the cap is in place, the firm has complete pricing flexibility, subject to the constant of the inequality (*), above.)

However, picking the correct adjustments of current prices to arrive at an initial level of the cap may involve troublesome disagreements. In fact, it might be argued that the whole history of R/R has been an attempt to arrive at correct prices. On the other hand, this same history provides a wealth of data that can serve as a basis for agreement in initializing the cap. There are two ameliorating circumstances:

i) The initializing process need be gone through only once, unless the price-cap formula needs to be revised.

ii) If the price-cap regime is transitional, as it should be for AT&T, then the level of the initial cap is not quite so crucial.

**c. Changes in the cap**

As we have stated, for incentives to be correct, the cap must be determined by an algorithm that does not depend on the firm's actual performance. It follows that only those changes in the firm's input costs that are beyond the firm's control should be reflected in the cap. These would include:

i) cost changes resulting from changes in the access-charge formula,

ii) effects of changes in tax law,

iii) effects of inflation, as measured by an index external to the firm.

To exclude such cost changes from influence on the cap would be unfair, and might even be infeasible if it led to financial difficulties for the firm. On the other hand, to reflect in the cap cost changes under the firm's control would remove or dilute the desirable incentive properties of the mechanism.

The firm's costs can be grossly classified under four headings, each of which can be thought of as proportionally represented in the cap:

i) access charges

ii) taxes

iii) expenses

iv) cost of capital.

For AT&T, access charges are by far the largest item. Their representation in the cap need not be adjusted for inflation, since their actual magnitude will already reflect the

effects of inflation on the costs of the local exchange companies. However, the portions of the cap representing expenses and the cost of capital should be so adjusted, and in two different ways. Moreover, income taxes should be adjusted proportionately to profit, hence approximately proportionately to the cost of capital.

First, if some selected appropriate external price index increases by 10%, for example, then the allowance for expenses should also increase by 10%. Second, if there is an exogenous increase in the cost of capital (which we here think of just as the interest rate) from 5% to 15%, then the allowance for the cost of capital should be tripled, as should taxes (under the approximation that they are all *income* taxes).

Table 1 shows by (fictitious) example how such individual adjustments to the cap would work, and how they would be chained together. In this example, a decrease in the access charge is followed by an increase of 10% in an index of the general price level.

The choice of inflation measure is another complex subject that we do not wish to explore here. The guiding principle is again that the index should be outside the firm's control; on the other hand, there should be reason to think that it fairly well tracks the firm's input costs.[12]

In addition to cost-adjustments, the cap may also include a target productivity allowance, that is a downward trend that represents a plausible rate of anticipated cost-reduction per unit of output. Through such an adjustment, the firm shares with its customers the benefits of anticipated increasing productivity (yet, because the target is determined in advance, the firm retains every dollar of cost saving it *actually* achieves). Of course, this adjustment should not represent the firm's actual year-to-year productivity increase, but should be a target, outside the firm's control, for incentive reasons. The productivity adjustment should be applied only to that part of the cap corresponding to

non-access expenses and capital costs. (Access charges will already reflect productivity increases by the local exchange companies.)

For AT&T, it is difficult to guess at an appropriate productivity allowance, because the time-series of cost data since Jan. 1 1984 is too short, and too subject to the accounting shocks and transients of divestiture. Nonetheless, some adjustment rate may have to be included in order to gain acceptance for the plan.

Finally we remark that this difficult point may be moot (unless the productivity adjustment is set unattainably high), since, as explained above, the cap may be just a safety net, while competition insures that productivity gains will eventually be shared by the consumers. Moreover, we remind the reader that all the adjustments discussed in this section are adjustments in the cap, not in prices.

**5. Summary and Comparison with Rate-of-Return Regulation**

We have urged that R/R be removed, in exchange for a commitment not to price above a pre-determined cap. A practical price-cap plan will have to specify the range of services to be capped, the initial level of the cap, rules for adjusting the cap, procedures to be followed if service elements are redefined, if the firm becomes financially straitened, and several other matters that we have not discussed.

It has sometimes been said that price-cap regulation reduces to R/R, since the algorithm that determines the cap will tend to be adjusted upward or downward when the firm's rate of return is too low or too high, respectively. We therefore conclude this paper with a comparison of the two methods.

R/R, with frequent rate reviews, should keep the rate of return approximately equal to the cost of capital most of the time. With price-cap regulation, suitably parameterized, the *long-term average* rate-of-return should equal the cost of capital, but the *actual* rate of

return in any year may deviate from that.

However, the two mechanisms differ in their incentive properties and in their costs. Renegotiation of the price-cap formula should be unnecessary, or at worst infrequent, since the most significant exogenous changes in economic circumstances will automatically be reflected in the price cap, without detailed cost studies, extensive proceedings, etc. This provides both a direct cost saving and an improved incentive for process and product innovation. The price-cap mechanism should thus lead to higher productivity growth, and hence increased consumer welfare, while reducing the cost of regulation.

## Notes

1. Of course, the opinions expressed in the present paper are our own, and not necessarily those of AT&T.

2. For example, talks at the Telecommunications Policy Research Conference in 1982, 1983 and 1986. The second of these appears as: Linhart, Peter B., and Roy Radner, "Deregulation of Long-Distance Telecommunications," in *Policy Research in Telecommunications*, V. Mosco ed., Ablex Publishing Company, Norwood, New Jersey, 1984, pp. 102-114.

3. See FCC Docket No. 87-313, "Notice of Proposed Rulemaking in the Matter of Policy and Rules Concerning Rates for Dominant Carriers."

4. See "Report to the Director General of Telecommunications," Her Majesty's Stationery Office, London, 1 July 1987.

5. Regulation as a principal agent problem is discussed in: Linhart, P. B., R. Radner and F. W. Sinden, "A Sequential Method for Direct Price Regulation," in *Proceedings from the Tenth Annual Policy Research Conference*, O. H. Gandy, Jr., P. Espinosa, J. A. Ordover eds., Ablex Publishing Corporation, Norwood, New Jersey, 1983, pp. 213-226.

6. Schumpeter, J. A., "Capitalism, Socialism, and Democracy," New York, Harper and Row, 1942. See p. 84. Schumpeter emphasized the mode of competition whereby a firm gains a temporary advantage ("monopoly power") over its competitors by being for a while the unique possessor of a technological improvement; firms leapfrog over each other in this way.

7. Baumol, W. J., "Reasonable Rules for Rate Regulation," in *Prices: Issues in Theory,*

*Practice and Public Policy*, Philadelphia, University of Pennsylvania Press, 1968.

8. See Littlechild, S. C., "Economic Regulation of Privatised Water Authorities," London, Her Majesty's Stationery Office, 25 January 1986.

9. An American reader of the documents pertaining to the introduction of price-cap regulation in Great Britain must be struck by the general atmosphere of peacefulness surrounding the discussion. In addition to possible differences in the litigiousness of national characters, this must have to do with the fact that British Telecommunications had no strong entrenched competition at the time.

10. Precisely: there exists no revenue rule that simultaneously guarantees efficient incentives and solvency, in the presence of arbitrary unobservable costs. This is shown in: Linhart, P. B. and F. W. Sinden, "Productivity Incentives Under Rate Regulation," Bell Laboratories Economic Discussion Paper #236, January, 1982.

11. The formation of price-indices, with fixed or variable weights, in the presence of a changing "market basket," is of course a subject that has been extensively studied, and one we do not wish to get into here.

12. For a study of what inflation measure would have been appropriate for the old Bell System, as of about 1980, see: Gale, W. A., "Price Index Components for Utility Rate Adjustments," *Public Utilities Fortnightly* 109, No. 8, pp. 33-38.

**Table 1: Adjustments of Cap**

| | | | |
|---|---|---|---|
| Initially: | Access charges | 58 | |
| | Taxes | 5 | |
| | Expenses | 32 | |
| | Cost of capital (at 5%) | 5 | |
| | | 100 | = initial cap |
| First adjustment: | Access charges decrease by 20% | | |
| | Access charges | 46.4 | |
| | Taxes | 5 | |
| | Expenses | 32 | |
| | Cost of capital | 5 | |
| | | 88.4 | = cap |
| Second adjustment: | 10% inflation in expenses; cost of capital increases from 5% to 15%; taxes triple | | |
| | Access charges | 46.4 | |
| | Taxes | 15 | |
| | Expenses | 35.2 | |
| | Cost of capital | 15 | |
| | | 111.6 | = cap |

ALTERNATIVES TO RATE OF RETURN REGULATION
Chair: Ronald Braeutigam

Ingo Vogelsang: Two-Part Tariffs as Regulatory Constraints

This paper introduces a regulatory two-part monopoly pricing mechanism with desirable properties. It requires no detailed prior information of regulators on the regulated firm and its environment. Also, subsequent observations of the regulator are restricted to verifiable bookkeeping data. Nevertheless, the pricing formula is simple and easily interpreted. The firm may freely choose the variable price of the two-part tariff as long as the fixed part obeys a constraint. The firm will then in every period receive an approximation to the welfare change caused by its price changes over the last period. Contrary to most other suggestions for incentive pricing the current approach requires no government subsidies.

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